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February 21, 2017

Ms. Marlene H. Dortch  
Secretary  
Federal Communications Commission  
445 12th Street, S.W.  
Washington, D.C. 20554

**Re: *Ex parte* presentation in IB Docket No. 11-109; RM-11681;  
IBFS File Nos. SES-MOD-20151231-00981, SAT-MOD-20151231-00090, and  
SAT-MOD-20151231-00091**

Dear Ms. Dortch:

On February 16, 2017, the undersigned on behalf of Ligado Networks LLC spoke via telephone with Charles Mathias, Associate Bureau Chief of the Wireless Telecommunications Bureau, about the final report by the National Advanced Spectrum and Communications Test Network (NASCTN) on the impacts of mid-band LTE signals on GPS receivers. I explained that this Government study was conducted by the research center jointly run by the U.S. Department of Defense and Department of Commerce and housed at NIST's facilities in Boulder, Colorado. This comprehensive Government study validates the conclusion reached by the major GPS companies over the last 14 months: An LTE network operating within the specifications proposed in Ligado's pending FCC applications will not harm the performance of GPS devices.

We discussed that the test results in this Government study found no impact on the position and timing accuracy of many GPS devices when exposed to mid-band LTE signals at significantly higher power than they would under Ligado's proposal. In addition, the results reported by NASCTN demonstrate that a simple antenna change can eliminate the impact Ligado's proposal might have on high-precision positioning devices.

We then discussed how the results from this Government study confirm Ligado's prior submission in the record that that a 1 dB-Hz decrease in the carrier-to-noise-density ratio ( $C/N_0$ ) is not the appropriate standard for assessing harm to GPS receivers. Indeed, there are many examples throughout the 428-page report showing  $C/N_0$  changes of *several* dB without any impact on device performance. The parties also discussed multiple test results in the NASCTN report showing a device's reported  $C/N_0$  *fluctuating (increasing and then decreasing and then increasing again)* while LTE power was consistently increasing. I explained that this evidence, which can be found in dozens of examples throughout the Government report, refutes any suggestion that a 1 dB change in  $C/N_0$  is a reliable predictor of GPS device performance. I noted

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that the NASCTN study, instead of using an unreliable proxy of impact (1 dB change in  $C/N_0$ ), measured changes in *both*  $C/N_0$  and the actual performance of the twenty tested devices, testing each device separately to avoid any interference from other devices during testing. I discussed how this process of measuring both  $C/N_0$  and performance may be more challenging than measuring just  $C/N_0$  (which apparently can be done in just a week in the lab), but the spectrum experts at Boulder concluded that was the best method to fully analyze GPS device performance. Accordingly, NASCTN performed 1,476 hours of testing and collected over 19,000 data files, which they subsequently processed to yield a set of 3,859 anonymized data files (780 MB).

I also discussed how the NASCTN report found that one contributor to the significant variability of  $C/N_0$  reported by the devices under test is the fact that GPS device manufacturers have a choice of  $C/N_0$  estimation algorithms—which is to say, there is no standard method for estimating  $C/N_0$ . Remarkably, the simulation study data in the Government report shows that the different algorithms estimate  $C/N_0$  in a manner that is *both* inaccurate and inconsistent. Indeed, the NASCTN simulation study shows that the vast majority of the devices under testing misestimated the actual  $C/N_0$  when the true  $C/N_0$  was 20 dB-Hz. This lack of a standard method to estimate  $C/N_0$  along with the inaccurate and inconsistent results from the simulation study further point to actual measurement of performance as the preferred method to assess impact on GPS.

I concluded by saying that this Government report completes the technical evaluation of how Ligado proposes to use its spectrum for ground-based services, and is the last in a long line of tests by multiple stakeholders. The Commission now has the information it needs to make this 35 megahertz of vital mid-band spectrum available to serve America's infrastructure needs.

Please direct any questions to the undersigned.

Sincerely,

/s/

Gerard J. Waldron  
*Counsel to Ligado Networks LLC*

cc: Mr. Charles Mathias